11. Lexical-Semantic Abilities of Individuals with Multiple Sclerosis and Aphasia

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Multiple sclerosis (MS), usually thought to be a progressive neurological disease, is one of the most common nontraumatically induced neurological illnesses affecting young and middle-aged adults (Poser, 1987). Estimates of incidence cluster around 50 to 60 individuals per 100,000 population, and age of onset is usually between the ages of 20 and 50 (Baum & Rothschild, 1981). The cause of the disease is unknown. The pathology primarily involves the destruction of the myelin sheath of nerve fibers. Areas that are particularly affected include the visual system and the periventricular white matter.

The clinical course is traditionally divided into "relapsing/remitting" and "chronic/progressive" (Silberberg, 1977). The significance of this classification for mental functioning is currently controversial (Beatty, Goodkin, Hertsgaard, & Monson, 1990). Further, recent longitudinal research has shown these categories to be unstable. During a 2-year follow-up, 46% of patients with "progressive" disease stabilized, while 44% of "stable" or "relapsing" patients showed some progression of disease (Goodkin, Hertsgaard, & Rudick, 1989).

The symptomatology of MS at times seems infinitely varied, reflecting the multiple sites of possible insult to the central nervous system (CNS). Weakness, loss of limb control, visual disturbance, numbness, vertigo, tremor, loss of taste, seizures, and genitourinary disturbance have all been reported (Silberberg, 1977).

While MS has not been prominently implicated in any discussion of the dementias, neuropsychological studies of MS have found evidence of

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cognitive impairment, including lowered-performance IQ and disturbances in learning and memory, in conceptual/abstract reasoning, in visuospatial processing, in vigilance and/or sustained attention, and in reaction time (Rao, 1986). Motor disturbances are also commonly found. Recent reports have found significant correlations between white matter disruption, as visualized on magnetic resonance imaging (MRI), and the extent and nature of such cognitive impairment (e.g., Franklin, Heaton, Nelson, Filley, & Seibert, 1988). While neuromotor disturbances of speech have been described in individuals with MS (e.g., Darley, Brown, & Goldstein, 1972; Farmakides & Boone, 1960) including a recent report of "aphemia," or apraxia of speech (Herderschee, Stam, & Derix, 1987), reports of aphasia are rare. In fact, "the limited number of published studies devoted to language functioning in MS suggest that either this important neuro-psychological function has been ignored by investigators or language dysfunction in MS is relatively uncommon" (Rao, 1986). Peyser, Rao, LaRocca, and Kaplan (1990) recently reiterated this opinion concerning language and MS.

However, Rao also abstracted the following examples of neuropsychological disturbances from the literature as of 1986: "impaired sentence learning," "impaired verbal learning," "impaired verbal recognition memory for MS patients using a semantic encoding strategy," and "impaired verbal learning and memory" (Rao, 1986).

Since these deficits are ubiquitous in aphasia and apparently unclear in MS, we present a modest descriptive study (a) to compare the effects of cerebrovascular accident versus MS on a sample of lexical semantic abilities and (b) to investigate the relationship of demographic and neurological variables to lexical-semantic abilities within the MS population.

METHODS AND PROCEDURES

Subjects

Forty-eight subjects with a diagnosis of MS rendered by their attending neurologists and 12 subjects with aphasia subsequent to left-hemisphere infarction were included in the study. The MS subjects were screened for other CNS pathology, sensory-motor impairment that would preclude full participation in the assessment procedures, and medical conditions with great risk for CNS complications. Descriptive data for subjects are presented in Table 11.1. The MS subjects were younger than the aphasic subjects ($p < .05$) and had slightly more education ($p < .05$).

TABLE 11.1. SUBJECTS

	Range	*Mean*	SD
MS[a]			
Age	25–57	42.6	6.61
Education (yrs.)	8–19	14.91	1.89
Time post-onset (mos.)	4–378	97.8	93.9
APHASIA[b]			
Age	48–77	64.7	8.46
Education (yrs.)	7–16	11.5	3.35
Time post-onset (mos.)	0.25–120	17.4	33.30
Overall %ile	37–88	61.5	18.82

[a]N = 48; Male: 14; Female: 34. [b]N = 12; Male: 12.

PROCEDURES

As part of a larger study of neuropsychological correlates of MRI findings, the MS subjects were administered the 60-item *Boston Naming Test* (*BNT*) (Kaplan, Goodglass, & Weintraub, 1983), the *Speech Sounds Perception Test* (*SSP*) (Reitan & Wolfson, 1985), and the Verbal Scale (VIQ) of the *Wechsler Adult Intelligence Scale–Revised* (Wechsler, 1981). All aphasic subjects received the *BNT* and the *Porch Index of Communicative Ability* (Porch, 1967). The MS subjects also received MRI of the brain within 2 weeks of testing. The MRI scans were given weighted scores by a neuroradiology fellow, which reflected number, size, and confluence of lesions in the white matter of each cerebral hemisphere.

RESULTS

The aphasic group performed in the impaired range (M = 38.2, SD = 19.59) on the *BNT*, using the cutoff of 48 correct responses or fewer, suggested by the normative data of Nicholas, Brookshire, MacLennan, Schumacher, and Porrazzo (1989). The MS subjects performed significantly more accurately than aphasic subjects ($p < .02$) and, as a group, performed in the "normal" range (M = 55.1, SD = 4.57). Given the magnitude of the difference in age of the two groups, an analysis of covariance, controlling for age, was used to compare the two groups.

For some of the subjects, it was also possible to analyze the type of errors produced on the *BNT*, according to the protocol of Nicholas et al. (1989). As can be seen in Table 11.2, differences in error response patterns were noted between the aphasic and MS groups, and the MS group

performed in a manner quite similar to the normative sample of Nicholas et al. (1989).

Turning to an inspection of the overall performance of the MS subjects (Table 11.3), as a group they performed within normal limits on the VIQ and the *SSP,* as well as on the *BNT.* Performance on the *BNT* was significantly correlated (Pearson *r*) with both of those measures, while the correlation between VIQ and *SSP* was not significant. No significant correlations were found between any of these measures and the MRI measures, age, or duration of illness.

While the MS subjects as a whole performed within normal limits on the *BNT,* it should be noted that four (8%) of this group obtained scores below 48, in the impaired range. When these subjects, tentatively referred to as "language impaired," were compared (*t* test) to the other MS subjects on related variables (Table 11.4), they were found not to differ in age, education, or length of illness, nor did they differ in severity or distribution of lesions on MRI. They did obtain lower VIQs and made more errors on the *SSP.* The significant difference in VIQ obviously leads to the question of whether the difference in naming performance on the *BNT* for these two groups of MS subjects could simply be a function of intelligence (even though the VIQs of the "language-impaired" group were in the "normal" range). In an attempt to answer this question, we identified the other subjects in the MS sample whose VIQs were at or below the mean level of the "language-impaired" subjects.

We now have two groups of MS subjects with lower VIQs than the MS group as a whole (Table 11.5). These two groups do not differ (*t* test) in age, education, or duration of disease, nor do they differ in MRI findings. Of course, they do not differ in VIQ. However, they still exhibit significant differences in performance on the *BNT* and *SSP.*

DISCUSSION

At the level of group comparisons, our findings replicate those of prior researchers concerning the basic language performance of MS subjects, as sampled by the *BNT* (e.g., Beatty, Goodkin, Monson, & Beatty, 1989). As a group, the performance of individuals with MS appears to be similar to that of normal controls. The current study suggests that this is the case both in level of performance and in patterns of errors.

However, there appears to be a small subset of MS subjects that does exhibit a naming disturbance on the *BNT.* This naming disturbance is not an isolated phenomenon; it is associated with disturbed auditory processing, as reflected by poor performance on the *SSP,* and with lowered VIQ. However, this naming disturbance is not attributable solely to generally

TABLE 11.2. ERROR PATTERNS ON THE *BNT* (PERCENTAGE OF TOTAL ERRORS)

	Normative Sample	*Multiple Sclerosis*	*Aphasia*
"Other name"	55	55	28
"Wrong part" or "visual misperception"	0.19	0.26	*
"Mispronunciation"	1.5	0.06	*

*Data not available.

TABLE 11.3. MULTIPLE SCLEROSIS RESULTS

	Range	*Mean*	SD
Age	25–57	42.6	6.61
TSO[a] (mos.)	4–378	97.8	93.9
VIQ[b]	84–128	105.8	9.74
SSP[c] errors	1–12	4.9	2.55
BNT[d] correct	40–60	55.1	4.57

	Correlations	
	VIQ	SSP
SSP	−.33	
BNT	.49*	−.49*

[a]TSO = time symptom onset. [b]VIQ = Verbal Scale of *Wechsler Adult Intelligence Scale-Revised*. [c]*SSP* = *Speech Sounds Perception Test*. [d]*BNT* = *Boston Naming Test*.
*$p < .001$.

TABLE 11.4. LANGUAGE-IMPAIRED (LI) MS VS. NON-LANGUAGE-IMPAIRED (NLI) MS

	LI (N = 4)	*NLI (N = 44)*
Age	43.00 (5.75)	42.55 (6.61)
Education (yrs.)	14.25 (3.96)	14.91 (1.89)
TPO[a] (mos.)	77.25 (54.74)	100.00 (96.27)
VIQ[b]*	95.25 (7.26)	106.70 (9.27)
SSP[c] errors**	9.25 (2.39)	4.57 (2.15)
BNT[d] correct***	43.00 (2.55)	56.16 (2.75)

[a]TPO = time post-onset. [b]VIQ = Verbal Scale of *Wechsler Adult Intelligence Scale–Revised*. [c]*SSP* = *Speech Sounds Perception Test*. [d]*BNT* = *Boston Naming Test*.
*$p < .05$. ** $p < .01$. ***$p < .001$.

TABLE 11.5. LOWER-IQ MS: LANGUAGE-IMPAIRED (LI) VS. NON-LANGUAGE-IMPAIRED (NLI)

	LI (N = 4)		*NLI* (N = 5)	
Age	43.0	(5.75)	38.2	(7.25)
Education (yrs.)	14.25	(3.96)	13.2	(2.14)
TSO[a] (mos.)	77.25	(54.74)	54.8	(42.29)
VIQ[b]	95.25	(7.26)	92.4	(2.8)
SSP[c] errors*	9.25	(2.39)	4.2	(1.47)
BNT[d] correct**	43.00	(2.55)	54.4	(2.33)

[a]TSO = time symptom onset. [b]VIQ = Verbal Scale of *Wechsler Adult Intelligence Scale–Revised*. [c]*SSP = Speech Sounds Perception Test*. [d]*BNT = Boston Naming Test*.
*$p < .02$. **$p < .01$.

lowered VIQ, nor can it be attributed to duration of illness, age, education, or the severity of lesions on MRI.

Thus, the *BNT* has identified, in this exploratory study, a group of MS subjects with a specific language disturbance that includes, but is not limited to, a naming disturbance. We therefore suggest that language functions in MS are an appropriate area for further research, and that clinicians should be sensitive to possible language disturbances in patients with MS.

This study is obviously exploratory and tentative. We view it as an example of "box-finding" research. That is, we have "found a box" (a group of apparently linguistically impaired MS subjects). We do not know what is in the box. It may be empty. At this point, we have not even measured the box, but we bring it to the attention of interested researchers and clinicians.

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